

The ample and systematic references to the literature, and the concise and full account of the best work, will make this part more useful than ever to the general student.

A Physiological, Histological, and Clinical Study of the Degeneration and Regeneration in Peripheral Nerve Fibres after Severance of their connections with the Nerve Centres.

By W. B. Howell and G. C. Huber. (Reprinted from the *Journal of Physiology*, Vol. xiii., No. 5, 1892; Vol. xiv., No. 1, 1893.)

The authors take up their subject under three subdivisions: a review of previous experimental work; an account of their own experimental work, and a critical resumé of surgical cases of primary and secondary suture.

Each subdivision is accompanied by very full reference to the literature.

It would seem as though a careful study of the manner in which the nerve breaks down in the process of degeneration, and builds itself up in that of regeneration, would add greatly to our understanding of the axis cylinder, the medullary sheath, and the nuclei of the sheath.

The observations of these authors were made upon dogs.

It appears that a nerve, separated from its nutritive centre, degenerates completely, almost simultaneously through its entire length, the medullary sheath being first affected, then the axis cylinder, the active agents in this process being the nuclei of the medullary sheath, which become greatly increased in number.

Of necessity, the method of investigation gives a series of separate, slightly different pictures; and the conclusions drawn depend upon the interpretations given to these pictures when considered in panoramic view.

As a natural result a great deal must be left to interpretation; and, after the very careful and cautious work by the authors, such questions as the origin of the medullary substance, and of the axis cylinder in the regenerating fibre, can receive no positive answer; nor is it plain from their work that the processes of regeneration are a repetition of the processes of development.

Concerning the response of the regenerating nerves

to different forms of stimuli, and the separation of the two functions of irritability and conduction, they have some good experiments. They also show that the central end of one mixed nerve may form functional connections with the peripheral end of another; and in the few instances in which this was tried in dogs, there was no consequent disturbance of function. We must have much more investigation along this line before general conclusions are permissible; but that there should not be a disturbance of function, when such an abnormal arrangement of the nerve fibres is effected, is difficult to explain in accordance with the current views concerning the architecture of the central nervous system.

Just here the subject of the third subdivision of their paper may be touched upon.

This critical resumé of surgical cases was taken up largely with the view of determining what evidence could be furnished for the idea that in man union of cut nerves was effected by first intention that is, without the preliminary degeneration of the peripheral portion of the nerve.

It turns out that multiple innervation of the skin and of muscles, whereby the section of one nerve trunk does not completely remove all the sensory or motor fibres going to a given region, will explain practically all the cases in man of so-called union by first intention; and it is just possible that the same condition of affairs is part of the explanation for the absence of functional disturbance following crossed sutures in dogs.

I give the conclusions drawn from the second portion of their paper, so far as they have placed them in their recapitulation.

1. After complete severance of connection with the nerve centres, the peripheral end of a nerve suffers degeneration throughout its entire extent.

2. The degenerative changes and the subsequent regeneration take place as follows:

- (a) Segmentation of the myeline and axis at the inter-segmental lines.

- (b) Proliferation and migration of the internodal nuclei.

- (c) Secondary fragmentation and absorption of the myeline (and the contained debris of the axis), most active in the neighborhood of the nuclei.

- (d) Increase of protoplasm round the nuclei, forming

finally a continuous band of protoplasm lying in the old sheath.

(c) Formation of a new sheath on the periphery of this band, thus making an "embryonic fibre."

(f) Union of the embryonic fibres of the peripheral end with these similarly formed in the central end—the union taking place in the intervening cicatricial tissue.

(g) Formation of myeline in the peripheral end as isolated drops usually seen first near the nuclei. These afterwards unite to form a continuous tube. The formation of the myeline proceeds centrifugally, starting from the wound.

(h) The outgrowth of new axes from the old axes of the intact fibres of the central end—the outgrowth following quickly upon the development of the myeline.

(i) In the central end, especially when connection with the peripheral portion is not made, several new fibres may form within the sheath of an old one, taking the place of the one degenerated.

On the Structure of the Nerve Cells and on the Relation of their Axis Cylinder or Nerve Process, to the Protoplasmic Processes.

By A. S. Dogiel (Archiv F. Mikroskopische Anatomie, B. 41, Heft. i., Bern, February, 1893.)

The observations recorded in this paper have been mainly made upon the nerve cells occurring in the retina of man and the lower vertebrates. With these cells the author is particularly familiar by reason of his careful researches into the structure of the retina, which he has carried on with the aid of the methylene blue method, which in his hands has been brought to a high degree of perfection.

As is well known at the present time, the majority of investigators dealing with the histology of the central nervous system, do not find the cell prolongations, either protoplasmic or nervous, anastomosing among themselves or with the prolongations of other cells.

Dogiel, in this present article, emphasizes several points which are novel, and contrary to accepted opinion.

He finds among certain nerve cells an abundant anastomosis of the fine branches of the protoplasmic processes.

He finds the nerve process arising at points very remote from the nucleated portion of the cell.